



Colony of Seychelles.

ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

YEAR 1933

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**STAFF OF THE AGRICULTURAL AND FORESTRY DEPARTMENT
SEYCHELLES.**

1. Hon. P. R. Dupont, F.L.S., Director of Agriculture.
2. F. L. Squibbs, Assistant Director.
3. W. Holdsworth, Distillery Expert.
4. E. Nageon de Lestang, Inspector of Plantations.
5. A. Hoareau, Assistant Inspector of Plantations.
6. N. Carrère, Clerk.
7. A. Gendron, Senior Forest Ranger.
8. E. Ethève, Forest Ranger, Praslin District.
9. A. Morel, Laboratory Assistant.
10. L. Albert, Store Keeper and Laboratory Attendant.
11. M. Tirant, Garden Foreman.
12. A. Azemia, Overseer.
13. J. Doway, Fisheries and Revenue Guard.

Notes on above.

1. Left the Colony on the 5th December on three months leave prior to retirement.
 2. Appointed to act as Director as from 5th December.
 3. Completed contract and left for England 27th February.
 4. Appointment terminated 31st December.
 9. New appointment.
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THE DEPARTMENT OF AGRICULTURE

FOR THE YEAR 1933.

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Botanical, Town and Hospital Gardens and Government House Grounds.

- 1.—*Flower Beds*.—A good show of flowers was maintained for the greater part of the year.
- 2.—*Hedges*.—Renewals were made in the hedges bordering the Fiennes Esplanade and the fencing repaired.
- 3.—*Trees*.—Pruning and extensive thinning out of trees, in the Botanical Gardens and Government House Grounds.
- 4.—*Roads*.—Heavy rains caused considerable damage to roads and paths ; the necessary maintenance and repairs were attended to.
- 5.—*Labelling*.—A plan of the Gardens was made, notable specimens being numbered and labelled.
- 6.—*Terraces*.—Extensive repairs were made to the terraces and steps at Government House.
- 7.—*Giant Tortoises*.—A new pen was constructed in a more public and drier part of the Garden. An early result of the transfer of 2 males and 2 females was the hatching out of 10 young tortoises ; assumed to be due to the drier nature of the ground. The number of adult tortoises cared for in the Gardens is 14 of an average weight of 77 kilos each.
- 2.—Work in the nursery and distribution of Economic plants.—Marked progress was made during the year with the development of the nurseries as shown by the list given below of the plants distributed :—

Eucalyptus citriodora...	...	...	15,120
Robusta Coffee	...	...	5,351
Allspice	...	...	78
Nutmegs	...	...	36
Pepper (imported)	...	...	50
Cocoa seedlings	...	...	225
Areca nuts	...	...	341
Onion seedlings	...	...	1,225
Citrus	...	...	97
Coconuts selected	...	...	111
Derris malaccensis (rooted cuttings)	...	...	10
Hydnocarpus seedlings	...	...	3
Fodder grass clumps	...	...	50
Casuarina seedlings	...	...	230
Tobacco seedlings	...	...	100
Letchi layers	...	...	12
Clove	...	...	10
Palmarosa clumps	...	...	550
Miscellaneous	...	...	490

Total 24,089

Eucalyptus Citriodora.—In spite of the difficulties of propagation, active attention was given to its production. Trade reports on the oil received towards the end of the year stimulated the demand for plants and extensive orders are on hand.

Propagation is either by :—

- (1) Seeds sown in boxes and potted into bamboo receptacles afterwards sold @ 4 cents each.
- (2) Seeds sown direct into a "Vacoa" or pot made out of a Pandanus leaf sold for 2 cents each, a price lower than cost of production.

Plants are difficult to raise, damping off in large numbers in wet weather, and are particularly sought after by mice and millipedes when in the seedling stage. Later at 3 inches height a degree of hardness is acquired.

A potting and seed shed has been erected for this work.

It is to be hoped that necessary funds will be available, as the present keen demand is likely to be maintained.

Seeds of *Eucalyptus Staigeriana* are on order. This species is said to possess a high percentage of oil containing 180/o geraniol and 160/o of Citral.

Coffee. Over 5,000 well-grown transplanted seedlings of *Coffea robusta* were sold at 1 cent each. Seeds of *Coffea excelsa* are on order from Tanganyika.

Areca-nuts. Importation of the larger seeded and better typed varieties of this palm was made from Ceylon.

Pepper. Propagation of the introduced varieties of South Indian, Malay and Ceylon pepper is proceeding as fast as cuttings become available on the stock plants. Cuttings of the older wood strike easily when inserted in boxes of pure sand under shade. Another method is to layer the plant in leaf soil.

Palmarosa. (*Cymbopogon Martini* var. *Motia*). Six plants of *Palmarosa* discovered in the Nursery amongst a plantation of Ginger Grass in October 1932 have been expeditiously propagated by division. Of the 4 to 5,000 plants raised 500 have already been distributed. The remainder have all been ordered conditional to a favourable report being received from the Imperial Institute on two samples of oil which were sent for examination. Ginger Grass in the Nursery was destroyed to eliminate the possibility of cross breeding. The plants do not appear to produce viable seed.

Citrus. Seeds of rough lemon were received from South Africa from which about 2,000 stocks are being grown for budding during 1934. Other stocks used are the Sour Orange known locally as the big "bigarades" and orange "mozambique". This work is proceeding very slowly owing to the absence of budwood from local sources and the consignments received from South Africa and Zanzibar arriving generally in bad condition. It is necessary therefore to wait for wood from plants received from South Africa during the year. Another serious drawback is the presence of Citrus canker on certain seedling citrus trees in the Gardens.

III. Plants Importations.

The Department is indebted to the Captain of H. M. S. "Emerald" for the safe transport of a valuable consignment of economic and decorative plants sent by the Curator of the Peradeniya Gardens, Ceylon.

This consignment included the following species and varieties of *Bougainvillea*, Mrs Butt., *Cypherii*, laterita, Mrs Frasier, and Maharajah of Mysore. Other plants received were 8 varieties of grafted mangoes which should eventually supply propagating material for the production of plants to replace the seedling varieties grown in this Colony.

The following gives a list of plants and seeds imported during the year :—

CITRUS	Country from whence received.			
Grapefruit Marshs Seedless	...	...	...	South Africa
" Triumph	...	...	...	" "
Lemon Villa Franca	...	...	...	" "
" Eureka	...	...	...	" "
Oranges Washington Navel	...	...	...	" "
" Valencia	...	...	...	" "
" Jaffa	...	...	...	" "
MANGOES				
Varieties Rupee	...	...	...	Ceylon
" Sembaddam	...	...	...	"
" Vella Ralumban	...	...	...	"
" Ampalavi	...	...	...	"
" Kametha Kalumban	...	...	...	"
" Vaira Randy	...	...	...	"
" Perie Caruppi	...	...	...	"
" Jaffna	...	...	...	"
MISCELLANEOUS				
<i>Bignonia radicans</i>	...	...	...	from Ceylon
<i>Tecoma Smithii</i>	...	...	...	" "
<i>Tabebuia rosea</i>	...	...	...	" "
<i>Cupressus pendula</i>	...	...	...	" "
" macrocarpa	...	...	...	" "
<i>Thuja orientalis</i>	...	...	...	" "
<i>Ixora macrothyrsa</i>	...	...	...	" "
SEEDS.				
<i>Eucalyptus citriodora</i>	...	...	...	South Africa
" ovata	...	...	...	" " "
" rostrata	...	...	...	" " "
" saligna	...	...	...	" " "
" globulus	...	...	...	" " "
" dives	...	...	...	" " and
<i>Myristica fragrans</i> large nutmeg	...	...	...	Australia
<i>Areca catechu</i> large variety	...	...	...	Ceylon
Groundnuts	...	...	...	" "
6 varieties <i>Cajanus indicus</i> (pigeon pea)	...	...	...	Madras
Pigeon peas green gram and Sorghum varieties	...	...	...	Hawaii
	...	...	...	Tanganyika

MISCELLANEOUS.

Corypha microclada	...	...	...	from Philippines
Licuala spinosa	...	...	...	" "
Livistona australis	...	...	...	" Sydney
" olivæformis	...	...	...	" "
" altissima	...	...	...	" "
" chinensis	...	...	...	" "
Sesbania grandiflora	...	...	...	" India
" coccinea	...	...	...	" "
Albizzia lebbekoides	...	...	...	" "
Adenanthera microsperma	...	...	...	" "
Pritchardia pacifica	...	...	...	" "
Prunus Capuli	...	...	...	" Mexico
Swietenia humilis and 20 other species of trees	...	...	...	" "

Consignments of citrus bulwood were received from Ceylon, Zanzibar and South Africa.

IV. Work connected with Insect Pests and Fungus diseases.

In last year's report mention was made of the receipt of a strain of a parasitic fungus (*Cephalosporium lecanii*) from the Director of the Imperial Mycological Institute. These cultures came originally from India where they were reported to be common on lecaniid scales.

Several plants, infected chiefly with lecaniid scales were collected and potted into kerosene tins. The plants were then carefully covered with a solution containing the spores from the tubes in which the fungus had been sent out. Specimens of leaves and stems were taken from the plants both before and after treatment and forwarded to the Institute for examination.

Extracts from the Director's letter and the report of the Mycologist Mr S. F. Ashby on the specimens submitted are given below.

(1) Extract from the Director's letter :—

"The results of the introduction of a virulent strain of *Cephalosporium lecanii* cannot be regarded as other than most promising. It is true that the Diaspid scales do not seem to have been attacked, but the infestation is well established on the Lecaniids, especially on the destructive scale on coffee. Its further progress may be left to nature, but there is every reason to hope that the fungus will play an important part in reducing the intensity of Lecaniid attacks in the Seychelles. One case only, that of III c, gave evidence that *Cephalosporium lecanii* was present in the Seychelles before this recent introduction (and I reported a similar case, regarding which however I had considerable doubt, some years ago), but the previously existing fungus evidently was not wide-spread or virulent, judging by its absence from the large number of scale consignments from the Seychelles that we have examined during the past 10 or 12 years. There is no doubt about the virulence of the recently introduced strain, which seemed to have commenced killing large numbers within two weeks of its application".

"It is evident that the cultures reached the Seychelles in a viable condition and were used with care and judgment to secure such successful results".

(2) Extract from the Mycologists's Report :—

"There seem to be definite indications that the cultures have taken on the lecaniid scales. The most striking infection was on all stages of *Lecanium viride* on coffee. The abundant infection of the young stages with the fringe visible after two weeks is noteworthy and a promise of effective control. The diaspid scales showed no fringe and are perhaps not attacked by *Cephalosporium lecanii*; the specimens, however, were collected only two weeks after treatment. Recent observations seem to indicate that the fungus has successfully spread over a wide area with efficient results".

Specimens of a Microlepidopterous insect causing severe defoliation of *Indigofera endecaphylla* and *Cajanus indicus* (pigeon pea) was identified at the Imperial Bureau of Entomology as being *Dichomevis ianthes*. A beetle boring through the shell of a Coco-de-mer nut was identified as being *Xyleborus perforans*. It is regretted to record the appearance of Citrus Canker both in the newly planted Citrus plot and amongst the stocks in the Nursery. This dread disease has been present in the Gardens for a considerable time. Neither Citrus Scab or Gummosis has been observed.

The Coconut Industry.

The following table taken from the Customs returns shows the quantities of coconut products exported from the Colony during the past 6 years.

	1928.	1929.	1930.	1931.	1932.	1933.
Copra per tons	... 4,974½	4,500½	5,909½	4,874¾	4,680½	3,216¾
Coconut oil Hect.	... 48	10	78	33½	10½	80
Coconuts Nos.	... 21,600	242,600	...	45,717	80,000	46,653
Soap Kgs.		...	...	...	...	600

It is probable that local consumption did not greatly exceed the average annual quantity. The year was marked by a steady fall in the price of copra. London prices declined from £13. 13 per ton F.M.S. in January to £10 at the close of the year. Calcutta prices for the same period fell from Rs 66 per kandy of 630 lbs in January, to Rs 57 for the December quotations.

The immediate result of this further decline in price was a reduction of labour and wages to the employees retained.

On many Estates cultivation has been practically abandoned, labour being solely employed for harvesting the crop. The most serious feature of the present position of the industry, is the extremely low crop returns per acre. For a general average at least 5 acres are required to produce one ton of copra per annum. If prices are stabilised at the present low level, the only solution to the problem of ensuring a respectable standard of living to an increasing population, is, by increasing, and close attention to, the development of subsidiary industries.

In the following chapter, the crop taken from 40 acres of the best bearing areas in the granitic islands illustrates the low yield of nuts per acre.

The causes of these low yields may be enumerated as follows:—

1. Initial lack of attention given to seed selection.
2. Poor planting methods.
3. Insufficient eradication of weeds, and use of cover crops.
4. Lack of manure.
5. Lack of drainage and hillside terracing.
6. Inter-cropping causing starvation conditions.
7. Attacks by insects and fungus diseases.

Comments on above.

(1) It is evident, that only very few Estates have systematically selected nuts for planting. It is well-known that coconuts in common with most economic plants display marked variation in their habits of growth and productivity. Careless selection of planting material cannot easily be remedied especially in the case of a long crop.

The experimental work carried out by the Department of Agriculture Malaya, has been based on the following practical principles.

Sound selection can only be based on the amount of copra produced per tree, under estate conditions. For this method of selection it is necessary, to study the producing qualities of individual trees, and, by a process of elimination ascertain which are the best trees on the estate. Having ascertained the best trees from the point of view of the number of nuts produced, the next step is to compare the amounts of dry copra produced by the nuts of each tree.

Having determined the best trees, their individual environments should be examined, for should any of them occupy especially favourable positions with regard to light and drainage they should be discarded, because their high productivity, which may be partially ascribed to their favoured situations might fall very low under normal estate conditions. For Seychelles it is probably advisable to choose one type adapted to sandy plateau, and another which has proved suitable for the hillside laterite soil. Finally only trees which appear healthy in every respect, and as nearly the same type as possible, should be chosen. Seed selection on the above lines was started by the department during the year.

(2) Whatever may be advanced for the expediency of planting coconuts on the Cori Islands, in deep holes, where hard pan prevents capillary rise from the water table, the practice has little justification in Mahé. All plants generally, should be planted with the collar at the same level or only slightly below the surrounding soil. Another mistake noticed is close planting. Root and head room are essential to the full development of the palm and for the average plateau soils. The trees should be planted at least 30 feet apart. Planting young trees under the shade of trees of an older generation is likewise a mistake. The space necessary for the young tree to achieve a normal and healthy development should be afforded right from the time it is planted out. Young trees inhibited from a normal development by lack of light and soil starvation during the early years of their growth suffer from a saprophytic vitality and in consequence cannot be expected to eventually develop into healthy bearing trees. The gaps in the cultivations which the Seychelles planters feel urged to fill, are usually caused by the depredations of the *Melittomma* beetle. More attention should therefore be given to safeguarding the older trees by constant vigilance, and by adopting the ear control measures so often recommended by the department.

(3) The plateau plantation should be thoroughly weeded and hoed at least twice a year. *Panicum pavifolium* a carpet grass, which is viewed somewhat seriously by planters, and no doubt is rapidly gaining ground in Mahé, can be easily controlled by 2 hoeings a year. The retention of the local *Desmodium* in cultivations by selective weedings, is a useful practice, but it is not a very efficient cover crop, and thorough weedings are somewhat neglected on this account. The department has now several useful covers which should be utilised and given a trial. Among those should be mentioned *Centrosema pubescens* and *Indigofera endecaphylla* both of which have been found to establish a good cover on certain Estates. *Ayastasia coromandeliana* (Mange tout) abounds on all Coconut Estates. It is lauded as a cover crop and makes an excellent fodder. It is not a leguminous plant and while successfully used as a cover, the way in which it is used as fodder is actually detrimental to the plantation. It is cut by the cattlemen and removed from the plantation to the byres and as generally, no efficient system exists of returning the manure to the field, its growth serves to assist in impoverishing the already over-burdened land. Systematic tethering of cattle in the plantation is therefore to be recommended.

(4) With surface cultivation and eradication of weeds is coupled the question of manuring. To urge manuring to-day in a country which during high price periods has not considered this elementary and profitable practice as worthy of much attention, is indeed a difficult matter. In the past, drainage water from the denuded hillsides, has no doubt provided a considerable annual quantity of plant food, but this cannot replace the amount of constituents removed annually in the process of cropping and in the fallen leaves and inflorescences. In Malaya these losses are computed at :—

Nitrogen	...	67 lbs. per acre per annum
Phosphoric acid	...	28 " " " "
Potash	...	125.5 " " " "

Neither can the available amount of sea-weed and distillery refuse supply this need, even assuming that it is all carefully conserved, treated and applied to the land. Whenever prices improve, or whenever a wise provision from the capital account allows, manures should be purchased, and planters should carefully study the results of the manurial experiments now conducted on the various Estates, made possible by Mr Stockdale's recommendation, and to the generosity of the Imperial Government. The aim of these experiments is to indicate the value of manuring with comparatively cheap organic fertilisers.

(5) It is pleasing to note that considerable attention has been paid during the year to draining of marshes. The marsh areas are very little above the high water level, and wide canals are necessary to increase the height of the cultivable land. Any lowering of the water table must re-act favourably on the palms and reduce the acidity of the land. Hillside draining has not been attempted, and it is a matter of regret that the department has not been able to demonstrate this useful practice.

(6) The principal intercrops used in the Coconut plantations of Mahé are Cinnamon and Patchouli.

The economic considerations governing this method of intercropping are possibly quite feasible, but the detrimental effect on coconuts is apparent. It is necessary to apply manure or decayed cinnamon leaves to ensure a crop of Patchouli, but it seems quite clear that Patchouli leaves little nourishment for the poor coconut as a counterbalance to the off times severe root disturbance suffered by the latter when Patchouli beds are being prepared.

(7) Scale attacks continue, with signs of abatement in some areas, and increased virulence in others. The factors accounting for this variation are not understood. Undoubtedly increased attention to cultivation and manuring, would improve the stamina of the trees and enable them to withstand heavy scale attack. The effect of the recently introduced virulent strain of the fungus *Cephalosporium lecanii* recorded in the earlier chapter is awaited with interest. The *Melittomma* beetle continues to take its toll of trees, and the small holder has been advised by travelling officers of the department as to the best methods of combating the pest.

The fungus diseases viz : *Thievalopsis paradoxa* & *Pestalozzia* sp. although frequently seen, do not constitute any great damage to the cultivations.

Coir.—A report by Dr. S. G. Barker on his study on the attributes and preparation of Coconut Fibre was published by the Empire Marketing Board in September. The importance of this report is, that Dr Barker, besides reviewing the attributes of the fibre and the existing methods of retting and extraction, directs attention to some of the many uses to which it could be put properly treated and rendered suitable for modern requirements.

It is hoped that as a result of these investigations, new outlets will be found for exploiting its uses, in directions hitherto, untried in commerce and industry.

Dwarf Coconuts.—1,000 nuts of each of the three varieties of the dwarf coconut were reported by the department on behalf of three planters. These varieties are recognised by the colour of their fruits and grouped as (a) red, (b) green end (c) yellow.

The dwarf variety is stated to have a higher yielding capacity than the ordinary coconut during the early years, but reported to be shorter lived.

The following conclusions to an article published in April entitled "Further observations on the Dwarf Coconut Palm in Malaya" by F. C. Cook, Assistant Chemist for Copra Research, and E. B. Jagoe, Assistant Economic Botanist, are worthy of record.

1. "The dwarf coconut palm appears to be more sensitive to unfavourable conditions than the tall palm, and responds rapidly and remarkably to improvement of deterioration in conditions."

2. While very remarkable yields at an early age are obtainable if conditions are favourable, in most instances, yields are only fair or poor, because the conditions do not fulfil the exacting requirements of the dwarf palm.

3. Free water movement in the soil is essential for good growth and the soil should not be allowed to dry up.

4. The best results have been obtained on very heavy clay.

5. The copra from dwarf palms is of inferior quality to copra prepared from ordinary tall palm nuts on a good kiln, and is unlikely to obtain a premium even if special care is exercised in manufacture.

6. The best dwarf palm copra is obtainable from the green variety and the worst from the red variety".

Manurial Experiments.

In accordance with the recommendation of Mr F. S. Stockdale C. M. G., C. B. E., Agricultural Adviser to the Secretary of State for the Colonies, financial assistance was secured from the Colonial Development Fund to provide for manurial experiments on Estates offering the required facilities.

The experiments were commenced in 1933.

The system adopted was to select an area with factors as homogenous as possible with regards to soil composition, surface level, age, condition of trees and previous treatment. On this area 4 suitably divided one-acre plots are marked out.

The conditions stipulated with the owners of the land are as follows:— Fertilisers are supplied and delivered free of charge to the Estate. Cost of preparation of the plots and application of fertilisers are borne by the planters.

An application of organic manure (sea weeds, cinnamon refuse, etc) has to be given, and the fertilisers turned in by cultivation of in trenches.

The trees in the selected plots are numbered, and the crop of individual trees recorded.

One plot was selected as control and the remainder manured as follows; thus correcting the order of manuring published in last year's report.

Plot "A"	400 kilogs	Fish Guano
" "B"	400 "	Cotton Seed Meal
" "C"	400 "	Bone Meal
" "	1000 "	Phosphate Guano
" "D"	Control,	No manure.

Altogether 19 series of experiments were commenced. During the year 3 were discontinued for various reasons, and, one series commenced at Bird Island. Of the 15 series which received the second application of manure 8 are located in Mahé, and the remainder in Praslin, La Digue and Sisters Islands. In an analysis of ten series made one year after the first manuring the following results are noted. These series comprise 40 acres of land with an average of 60½ trees to the acre in 1932 and 60 trees in 1933 owing to the loss of 10 trees in all plots for the year.

	1932	1933
Average yield per acre for all plots (nuts)	1,452	1,560
" " " tree " " " "	24	26
" " " " " Plot A "	22	25
" " " " " B "	27	28
" " " " " C "	24	28
" " " " " D "	24	28

While an appreciable improvement in yields is noted in all plots, the full effect of the first year's manuring would not be fully apparent. The increase which is general in all plots can also be largely accounted for by the effect of better cultivation.

Sale of Fertilisers.

The following quantities of fertilisers were sold to planters during the year:—

Sulphate of potash	...	13 cwts.
Mixed Fertiliser	...	7 tons
Guano	...	4 "

Essential Oil Industry.

The following figures show the quantities of essential oils exported during the past four years.

		1930.	1931.	1932.	1933.
Cinnamon Leaf Oil	Kilos	50,476	54,793	49,669½	60,684
" Bark Oil	"	—	—	30	29
Patchouli Oil	"	2,341	3,915	2,424	614½
Basilic Oil	...	23	12	3	—

A summary of the extensive report submitted by the expert distiller, Mr Holdsworth, on the result of his investigations is published as an Appendix (A) to this report.

The report constitutes a valuable and authoritative guide both to the department and for distillers of the Colony.

Stills.—The report criticised stills used in the Colony, and gave valuable direction regarding improvement of design. A still of large capacity built on lines recommended by Mr Holdsworth, has been bought by the Seychelles Produce Coy for erection on their estate at Grand'Anse.

Cinnamon.—Mr Holdsworth called attention to the overcropping of Cinnamon now existing, and the need for conservation. The suggestion made for the introduction of a close season is essentially sound but would cause distress to planters if enforced during this abnormal period of depression. It is intended to restrict cropping and reduce sale of Cinnamon in Crown Land areas.

Cinnamon Bark Oil.—Little further interest has been taken in the production of this oil chiefly due to the poor demand.

Patchouli.—Samples of oil distilled from plants received the previous year from Ceylon stated to be the Penang variety, were forwarded to the Imperial Institute for examination. The Director's letter precedes the report on the second sample of oil.

Patchouli Oil from Seychelles.

"The sample of patchouli oil which is the subject of this report was forwarded to the Imperial Institute by the Director of Agriculture, and is referred to in his letter No. C498/33 of the 29th May 1933.

The oil was stated to have been distilled from plants which had been introduced into Seychelles from Ceylon as representing the typical Singapore variety".

Results of Examination.

"The sample, consisting of 17 c.c. of a clear yellowish-brown oil, was found to have the following constants, which are shown in comparison with the corresponding figures for the three previous samples of patchouli oil from Seychelles dealt with in Imperial Institute report of the 29th January 1932 and with those recorded for Singapore and Java oils" :—

	Present Sample.	Previous Seychelles Patchouli Oil.			Recorded figures for Patchouli Oil.	
		No. 1.	No. 2	No. 3.	Singapore	Java
Specific Gravity @ 15.5/15.5 C.	0.9368	0.703	0.9635	0.9572	0.960 to 0.980	0.925 to 0.935
Optical Rotation & D.—	—4.48 at 21 C	—55.6 at 22 C	—50.3 at 22 C	—46.6 at 22 C	—47 to 61 to	+3.15' to =32.17'
Refractive Index n _D 20 C	1.5033	1.5096	1.5089	1.5082	1.508 to 1.512	1.5000 to 1.5080
Solubility in 90 per cent alcohol at 15.5 C	Soluble in 6.1 vols.	Soluble in 7 vols.	Soluble in 8 vols.	Insoluble even in 11 vols.	Mostly soluble in 5 to 8 vols.	Soluble in 6 to 8 vols

"These results show that, except as regards solubility in alcohol, the constants of the present oil differ markedly from those of Singapore patchouli oil, and also from those of the last three patchouli oils from Seychelles examined at the Imperial Institute; they are however generally similar to the recorded figures for Java patchouli oil.

The odour of the oil was not very strong, and was distinct from that of any of the three oils from Seychelles referred to above".

Commercial value.

The oil was submitted to (a) and (b) essential oil distillers and (c) importers in London who furnished the following reports respectively:—

(a) "The sample has been examined in our laboratory and we find that the specific gravity, refractive index and optical rotation are all very much lower than those of ordinary normal Singapore or Seychelles oils. The solubility is good and is more in line with Singapore oil. The odour is clean and free from the usual birch-tar smell of Seychelles oil, but not so powerful".

"The better solubility and the removal of the birch-tar odour are satisfactory, but these improvements do not balance the other differences. We are afraid, therefore, that more work will have to be done to produce an oil that will be acceptable on the market".

(b) "Our figures agree with your own, but, as you are aware, these do not represent the characters of true patchouli oil, particularly the low specific gravity and rotation. The odour compares badly with ordinary imported oils, so that one cannot help thinking that the material used for distillation could not have been of the correct quality. The value of the oil would be very problematical".

(c) "This oil has not such a pleasant or lasting odour as a sample of English distilled patchouli oil (from Ceylon leaves), but is very similar in odour to a recent purchase of foreign oil. The frative properties of the oil do not seem to be as good as an average sample, and we would hesitate to recommend the use of this oil for perfumery."

Remarks.

"From the foregoing results it will be seen that the constants of this oil differ considerably from those of Singapore patchouli oil but are generally similar to those of the Java oil. It would appear that if the plants represent the Singapore variety of patchouli a great change in the character of the oil has been induced by the local conditions in Seychelles.

The trade reports on the oil are unfavourable and it seems unlikely that it will be worth while to extend the cultivation of the plants in question. Before coming to a final decision on this point, however, it would be desirable to prepare and forward a further sample of the oil for examination in comparison with the results recorded in this report."

15th August, 1933.

Imperial Institute,
London, S. W. 7,
25th October, 1933.

Sir,

With reference to your letter No. C.809/33 of the 12th September, I now enclose for your information a copy of a report which has been despatched to His Excellency the Governor on the further sample of patchouli oil which you submitted for examination.

It will be observed that the oil is of similar character to the previous sample from the same plants, and as indicated in Imperial Institute report of the 15th August it is unlikely that it will be worth while to proceed with the cultivation of these. If they were originally of the true Singapore type it is evident that a marked change in the oil has taken place.

From previous work carried out at the Imperial Institute (see report dated 8th May 1929) it appears quite clear that the patchouli plants already grown in the Seychelles are capable of yielding an oil equal to the commercial oil shipped from Singapore, and this has been recently confirmed by Mr Holdsworth Haines in his report to the Colonial Office. It would therefore appear more desirable to encourage the cultivation of these plants than to introduce new stock unless of a definitely superior type.

I am, Sir,

Your obedient servant,
(sd) W. S. FURSE,
Director.

The Director of Agriculture,
Seychelles.

Report on Patchouli Oil from Seychelles.

"The sample of patchouli oil which is the subject of this report was forwarded to the Imperial Institute by the Director of Agriculture, and is referred to in his letter No. C.809/33 of the 12th September 1933.

The oil was stated to have been distilled from plants which had been introduced into Seychelles from Ceylon as representing the typical Singapore variety, and was submitted for examination in continuation of the investigation of a sample of similar origin which was forwarded in May 1933 and formed the subject of Imperial Institute report of the 15th August 1933".

Results of Examination.

"The sample, which was stated to have been distilled on the 21st August 1933, weighed about 3/4 oz. and consisted of a clear, pale yellowish-brown oil. It was found to have the following constants, which are shown in comparison with the corresponding figures for the previous sample from the same plants and with those recorded for Singapore and Java patchouli oil :—

	Present Sample.	Previous Sample.	Recorded figures for Patchouli oil.	
			Singapore	Java
Specific Gravity at 15.5/15.5 C	0.9333	0.9368	0.960 to 0.980	0.925 to 0.935
Optical Rotation α_D at 19 C	—3.25	—4.48	—47 to —61	+ 3.15' to —32.17'
Refractive Index n_D 20 C	1.5030	1.5033	1.508 to 1.512	1.5000 to 1.5080
Solubility in 90 per cent alcohol at 15.5 C	Soluble in 6.4 vols.	Soluble in 6.1 vols.	Mostly soluble in 5 to 3 vols.	Soluble in 6 to 8 vols.

"From these results it is seen that the characters of the present sample of patchouli oil are similar to those of the previous sample, and that they are not in agreement with those of normal Singapore patchouli oils derived from *Pogostemon patchouli* Pellet, but generally resemble those recorded for Java patchouli oil, which is said to be distilled from *P. Heyneanus* Benth., a species indigenous to India. As in the case of the earlier sample the odour of the oil, though pleasant, lacks the intensity of that of the Singapore patchouli oil of commerce. It would therefore appear undesirable to encourage further cultivation of the plants from which this oil was produced".

25th October, 1933.

Palmarosa.

It is gratifying to be able to record the verification of the purity of the Palmarosa mentioned in an earlier chapter of this report.

Now arises the important problem of safeguarding the purity of the product by preventing any further mixing with Ginger grass which is almost identical in appearance. The names Motia (Palmarosa) and Sofia (Ginger Grass) express the relative values of the essential oils obtained from the two varieties. Motia means a pearl i. e. precious, whilst Sofia means inferior. Motia oil (Palmarosa oil) consists of 80—90 per cent of alcohols chiefly an alcohol called Geraniol. Sofia oil (Ginger Grass oil) contains of a good deal of geraniol, another alcohol which is a dihydracumic alcohol and the strong smelling substance—icarvan. Motia and Sofia oils therefore differ in the presence or absence of these two substances. Although distillations of Ginger Grass are no longer carried out the grass occurs in Mahé on many Estates. It has of course an economic value, but it is obvious that a Palmarosa industry will not succeed if Ginger Grass is not eradicated. Mistakes and adulterations are bound to occur. From the aspect of cultivation, Palmarosa appears to succeed equally as well as Ginger Grass.

Legislation is now being considered to enforce the destruction of Ginger Grass. The report received from the Imperial Institute on the two samples of oil submitted is as follows :—

Report on

Palmarosa Oil From Seychelles.

The samples which are the subject of this report were forwarded by the Director of Agriculture, and are referred to in his letters No. E3/843 dated 21st September and No. E3/960,33 dated 9th November, 1933.

The oils had been experimentally distilled from plants of a variety of which 3,000 had been raised vegetatively from six plants recently isolated by Mr. Holdsworth, who was sent out to Seychelles to report on the position of the essential oil industry in the Colony.

Description.

No. 1 (September). 20 cc. of a clear, pale greenish-yellow oil, from which a few drops of water had separated.

No. 2 (November). 65 cc. of a clear reddish-brown oil.

Results of Examination.

The oils were examined with the following results, which are shown in comparison with those of a previous sample of palmarosa oil from Seychelles examined at the Imperial Institute (see report dated 9th February 1932) and with the figures recorded for commercial palmarosa oil :—

	Present Sample	Previous Sample	Recorded figures for Indian Palmarosa oil.
	No. 1.	No. 2.	
Specific Gravity at 15.5/15.5 C	0.8960	0.8968	0.9083
Optical Rotation α_D	0.03	—0.22	+3.1
	at 24 C	at 18 C	at 20 C
Refractive Index n_D 20 C	1.4715	1.4722	1.4796
Acid Value	1.2	1.0	1.4
Ester Value	97.2	90.3	46.1
Ester Value after acetylation.	276.1	273.5	262.3
Equivalent to "total alcohols" (expressed as geraniol), per cent	95.8	94.6	89.8
Solubility in 70 per cent alcohol at 15.5 C.	Soluble in 1.8 vols.	Soluble in 1.6 vols.	Soluble in 1.6 vols.

"These results indicate that the present oils, giving a high figure for "total alcohols", were obtained from the "Mofia" type of grass from which the palmarosa oil of commerce is derived. The oils contained however an abnormally high percentage of esters, so that the percentages of free geraniol in the oils (indicated by the difference between the ester value before and after acetylation) were rather low compared with those present in good commercial samples of palmarosa oil and also in the earlier sample from Seychelles.

The odour of sample No. 1 was very pleasant and devoid of any suggestion of ginger-grass oil, but as it contained less free geraniol the odour was not so strong as that of the previous sample. The odour of No. 2 was less pleasant than that of No. 1".

Commercial Value.

The samples were submitted to a firm of essential oil distillers in London, who reported on them as follows :—

"No. 1. The high specific gravity and low refractive index is in keeping with the high ester value. The oil has a sweeter note than Indian oil and is slightly more geranium-like. The oil yields a very sweet-smelling geraniol and seems to be free from ginger grass odour.

No. 2. "This sample has also a high specific gravity, low refractive index and high ester value. The first odour is not very sweet, but after exposing on filter paper for about 4 hours the less volatile oil derived develops a very sweet odour, that of geranyl acetate being very pronounced.

Geraniol produced by saponification is very sweet and clean, but not quite so nice as Sample No. 1.

"Both types should find a good market, both for production of geraniol and for use in good class toilet soap, where the high percentage of esters (33 per cent calculated as geranyl acetate) would be very useful in rose compounds.

"From the above it would be apparent that on odour the oil in question is rather better than that from India. There is no question that oils of the palmarosa type have a specific use in connection with the preparation of rose odours, but their market is limited and of late years the demand for Indian Palmarosa oil has been a decreasing one. The present price on the Indian oil is somewhere in the neighbourhood of 5s 9d to 6s per lb c.i.f."

30th January 1934.

Citronella and Lemon Grasses.

Grasses growing in the Botanical Gardens which appeared to possess distinct morphological characteristics were sorted into 5 separate groups.

4 groups were distilled and the oils sent to the Imperial Institute. Reports on the first groups were as follows :—

No. 1. Not normal Citronella nor Lemon Grass oil production not recommended.

No. 2. Low grade Lemon grass oil—62 o/o Citral production might be profitable.

No. 3. Same as No. 1.

Report on oils produced from supposed Cochin Lemon Grass grown on an Estate at Bel Air. (These oils were labelled Nos. 4, 4a and 4b).

Not normal Lemon or Citronella Grass oil. Inferior quality. Production not recommended. The report on Sample No. 5, a group growing in the Gardens, and on No. 6 produced from the local lemon grass was as follows :—

Report on

Citronella and Lemon Grass oils from Seychelles.

The three samples which are the subject of this report were forwarded to the Imperial Institute by the Director of Agriculture, and are referred to in his letters No. E 3/960/33 and E/961/33 of the 8th November 1933.

Description.

The samples were labelled respectively "No. 4b", "No. 5" and "No. 6", the corresponding quantities being 470 cc., 103 cc. and 47 cc. Each sample consisted of clear, pale yellowish brown oil.

Results of Examination.

The three oils were examined with the following results, which are shown in comparison with the figures recorded for Ceylon and Java citronella oils and East Indian lemon grass oil. The results of the examination of five previous samples of these oils from Seychelles are given in Imperial Institute report of the 25th October 1933.

Commercial value.

The foregoing results show that the characters of sample No. 4b are practically the same as those of the previous samples 4 and 4a (see Imperial Institute report of the 25th October 1933). It also possessed a similar odour, suggesting a mixture of lemon grass oil and Citronella oil. As previously mentioned, oil of this character would not be readily saleable, and could not compete in the United Kingdom with normal lemon grass and citronella oils.

Sample No. 5 has the characteristic odour of citronella oil but possibly rather weaker than that of good Ceylon oil. Its constants are in general agreement with those of Ceylon citronella oil. This sample was submitted to a firm of importers in London, who furnished the following observations:—

From the analysis this oil resembles very much what is known as "Estate Quality Ceylon Oil", that is to say a pure Ceylon oil, without the usual percentage of kerosene. The total acetylisable constituents of Ceylon Estate Oil run between 60 and 65 per cent, and to-day's value is approximately 1s 3/4d to 1s 3d per lb c. i. f.

"The odour of the Seychelles oil is not particularly attractive at first, but improves after exposure to the air, and we think that there would be a market for considerable quantities if it can be produced at a competitive price. In order to introduce it, it would probably be necessary to undercut the Ceylon price at first, but eventually we think it would sell on equal terms or possibly command a very small premium".

This sample No. 6 is a lemon grass oil of satisfactory odour and contains a high percentage of citral, the amount being above the average for commercial samples of Cochin lemon grass oil. It will be observed that the oil is insoluble in 70 per cent alcohol, and in consequence it would be classed as an "insoluble" oil. The trade at one time generally preferred "soluble" lemon grass oil, mainly because this character was taken as an indication that the oil had been well prepared and properly stored, but little importance is attached at present to this property as the oil is now employed principally as a source of citral.

Lemon grass oil from Seychelles of the quality of the present sample (containing 86.5 per cent of citral) should be readily saleable in competition with Cochin lemon grass oil, which is now quoted in London at 3s 8½d per lb c. i. f.

30th January, 1934.

Present Samples.		Ceylon Citronella Oil.	Java Citronella Oil.	East Indian Lemon grass Oil.
No. 4b	No. 5			
Specific Gravity at 15.5/15.5 C	0.9042	(0.895 to 0.910)	(0.885 to 0.925)	(0.895 to 0.907)
Optical Rotation α_D	-14.20° at 22° C	-7° to -18°	0° to -3° (rarely slightly positive).	+1 to -5°
Refractive Index n_D 20 C	1.4800	1.479 to 1.485	1.465 to 1.472	1.4825 to 1.4885
Aldehydes (*bisulphite method), per cent by volume	9	—	—	70 to 85
Aldehydes, expressed as citronellal (hydroxylamine method), per cent by weight	7.1	0.5 to 8	35 to 46	—
Ester Value after acetylation equiva- lent to total acetylisable constituents (expressed as C H O), per cent	211.5	—	—	—
Solubility in 80 per cent alcohol at 15.5 C	Soluble in 0.7 vol. Not soluble in 10 vols. of 70 per cent alcohol.	Soluble in 1.5 vols.	Soluble in 2 vols., becoming not more than slightly opalescent with 10 vols.	(Soluble in vols of 70 per cent alcohol).

*The bisulphite method is the approved commercial method for the estimation of citral in normal lemon grass oils.

+The hydroxylamine method is that recognised by the Society of Public Analysts for the estimation of citronellal in citronella oil.

Minor Industries.

Eucalyptus citriodora.—Keen interest is now being taken with this tree, and plantations are being established as rapidly as plants become available.

It makes rapid growth and seems to succeed best when planted out on hill sides in red soil and exposed to full sunlight. It is however, rather delicate in the young stages when compared with other *Eucalypti* but with careful treatment planting losses can be reduced to less than 5 o/o.

An instructive leaflet has been issued to planters on the propagation and after care of the plant. Trees should be planted on hillsides 8'x6' apart with a line of lemon grass between each row as an inter-crop and preventive of soil erosion. Successful marketing of the oil should considerably enhance the value of hillsides areas which, except where Cinnamon predominates, are tending to revert to bush.

The oil produced locally is pronounced as being of satisfactory quality and saleable. It is evident however that the first cropping should not be made until the young tree has made considerable growth and formed a hard stem. Our present experience likewise shows the inadvisability of cutting back lower than 3 feet above the ground.

The reaction of the tree to cropping is being studied in the department's experimental plots.

Coffee.—Interest is now being taken in the planting of coffee. It should be possible within a few years to dispense with the importation of coffee for local consumption. The robusta variety succeeds well under Coconuts on the plateau. A demonstration plot now growing in the Botanical Garden should form an instructive guide to planters whose knowledge of plant husbandry has been sadly circumscribed by exclusive experience of the two crops i.e. Coconuts and Cinnamon which undoubtedly show less intolerance to lack of attention and cultivation.

Pepper.—Efforts were made to accelerate the propagation of the varieties received during the last few years from Ceylon and South India. The parent trees produced excellent crops of berries demonstrating their adaptability to conditions in Seychelles.

The suitability of Seychelles for pepper growing is shown by the luxuriant growth made by the local variety. Planters are therefore advised to propagate and extend their plantings of the imported varieties as rapidly as possible.

The vines are growing on Capucin posts under slight shade. The plants prefer the red soil which should be thoroughly mixed with well decayed leaves.

The vine usually commences to crop in the third year coming into full bearing about the sixth year.

Lemon Grass.—By the report published in another chapter it will be noted that Seychelles has its "petite citronnelle" possesses a lemon grass producing oil of high quality. This grass is now being actively propagated by the department and planters. Distillation experiments will be undertaken to ascertain the right time to crop, in order to obtain the maximum yield of oil.

Areca Nuts.—Planters generally are rather reluctant to plant this palm, probably owing to the period which must elapse before a crop is obtained. It is a crop worthy of consideration and planters should avail themselves of the young plants now being propagated in the department's nurseries.

At the time of writing this report the local Ceylon price for nuts in husk was 25 cents per 100, and Rs 13 to Rs 14 per cwt for the dried product.

Nutmegs.—This tree thrives best in sheltered situations in alluvial soil. Such places as would prove most suitable in Mahé are to be found bordering the rivers and streams on the lower levels.

A market should be easily found for the nutmegs and mace. Perhaps more important is the heavy yield of oil which is distilled from the kernels. A distillation made at the Botanical Gardens by Mr Holdsworth gave a very high yield of oil. Seed of the larger fruiting varieties have been recently imported by the department from Ceylon.

Onions.—The results obtained from the experimental plantings made during the year show that onion cultivation presents considerable possibilities for profitable development. This department has arranged to obtain seeds for planters. The varieties ordered are the Bermuda red and white and another called Crystal Wax. All those varieties succeeded very well, and better than the Dhulia Onion obtained from Bombay. As the harvesting of the crop must be carried out before the beginning of the rainy season, seeds should be sown during the months of March and April.

Cardamoms.—The growing of Cardamoms is advised on all Estates possessing sheltered and shady situations in the mountain areas. The plants succeed well in the Government Forest areas producing good crops of fruit. They should be planted in well prepared holes 6'x6' apart.

The main requirements of the Cardamoms are (a) shade, (b) protection from wind, (c) abundant moisture, (d) a rich loamy soil. After planting out little attention is needed. The first crop may be expected in the third year.

Seeds and plants are available on application at the Botanical Gardens.

Livestock.

Cattle.—The Friesian herd owned by the Department consists of two bulls, one bullcalf, one cow and 2 pregnant heifers. The latter were released in June from a 6 months' quarantine following their importation from Mauritius. Both animals are thriving well. The younger bull was sent over to Praslin under the care of planters who allow service at the rate charged by the department.

The introduction of this stock, which has undoubtedly been most successful, may be considered adequate for the time being.

Silkworms.—The following report on Silk made from cocoons forwarded by the department is of interest :—

Reeling Trials of Seychelles Cocoons.

Report furnished by the Cyprus Silk Filature Ltd., Yeroskipos.

Weight of Cocoons received.....	60 Gr.
Weight of Reeled silk produced.....	11 „
Weight of Struza.....	4 „
Rendement.....	5.4545XI.
Percentage of Struza.....	36.36%

Cocoons. “These cocoons resemble a type of “Yellow Pur” and are small and of oval form. The colour is dirty yellow. The crust (outer layers of silk) is very hard ; in order to soften the cocoons it was necessary to leave them for a long time in boiling water. Once the gum was softened the unwinding was sufficiently good and without interruptions. The excessive hardness of the cocoons may be due to the way they were dried, and also to the long time which has elapsed since they were produced.

The relative scarcity of silk covering the cocoons may be due to the worms having been fed on a thin and poor leaf.

Silk. “The silk is sufficiently coloured though it has a tendency towards paleness. It has a good firmness and is fairly clean”.

Observations by the Imperial Institute Silk Committee.

“Special attention is drawn to the high percentage of struza (knubbs or waste) and to the relatively low rendement.

The high proportion of struza, namely, 36.36o/o, compares unfavourably with the corresponding percentage for Cyprus cocoons which is usually about 20o/o or even as low as 17o/o. The abnormal amount of struza is to be attributed to the “excessive hardness”, of the cocoons referred to in the report on the cocoons, a defect which commonly results from unsatisfactory methods of stifling : over-baking the cocoons, when dry heat is employed for this process, is a well-known cause of hardness in cocoons. No particulars have been received as to the method of stifling adopted by the Director of Agriculture, but is recommended that the simple steaming process previously suggested by the Committee should be employed as likely to afford the best results. Special attention should be given to this point since the reeled silk obtained from the cocoons when the hard outer layers of struza had been removed is very satisfactory as regards softness, as will be noted from the sample sent herewith.

The rendement of 5.4545 X 1 indicates that 5.45 units by weight of cocoons were required to yield 1 unit of reeled silk. This return is low since the average rendement of good cocoons is about 4.0 to 1. The relatively small yield of silk may in part be due to insufficient feeding of the worms as suggested in the report. A low rendement, however, is usually obtained when very small quantities of cocoons are reeled, as in the present instance ; under the circumstances a figure of 5.45 should not be regarded as unpromising.”

31st July 1933.

Eri-Worm.—“The successful introduction of the eri-worm has shown that it thrives remarkably well in Seychelles. Several persons have interested themselves in rearing them and enquiries have been made concerning a market for the cocoons. A report recently received from the Imperial Institute states the position regarding marketing possibilities in the United Kingdom

Advisory Committee on Silk Production.

Eri Cocoons from the Seychelles.

“The small sample of Eri cocoons which is the subject of the following report is referred to in the letter from the Director of Agriculture Seychelles, No. C 704/33 of 14th August 1933

The cocoons were brought before the Committee for examination and report as to the market prospects of cocoons of this character in the United Kingdom and the price likely to be obtainable for them.”

Examination and Market Valuation.

“The cocoons were regarded as being of good size and shape, clean and bright in colour and as likely to afford a satisfactory yield of silk.

Samples of the cocoons were therefore submitted to three firms in the spun silk trade one of the firms was represented on the Imperial Institute Advisory Committee on Silk Production ; others were recommended by the Committee as referees”. The reports received were as follows :—

“Messrs Lister and Co., Ltd., (Manningham Mills, Bradford), represented on the Committee by Mr. W. H. Watson, reported on the cocoons as follows :—

"We have examined the sample of Eri silk cocoons from the Seychelles and we consider them to be exceptionally clean cocoons, yielding about 80/o of silk".

They are covered with white floss which is practically "noil" and which amounts to approximately 50/o less than that obtained from the best quality Eri cocoons. We should say that the cocoons are worth from 1/— to 1/3 per lb., but it is rather difficult to state a definite price on such a small sample".

Messrs Thomas Taylor and Co. (Brown Street, Manchester).

"There is only a very limited scope for Eri cocoons in this country as they lend themselves more to the Continental schapping process for spun silk. On examination of the small sample submitted we should value them at about 1/— per lb. It is, however, very difficult to give a reliable estimate on so small a sample".

Messrs. H. T. Gaddum and Co. (Great Bridgewater Street, Manchester).

"We are sorry to say that there is practically no prospect of business in Eri cocoons at the present time.

The experiments in the Seychelles could hardly have started at a more inauspicious moment, as the values of all kinds of natural silks have fallen to an unprecedented low level.

Chinese Tussah waste, the material with which Eri silk has to compete, is being sold here at under 6d per lb., for the very best quality, and on referring to our records we find that at times we used to sell Eri cocoons at about 20/250/o below the price of best Chinese Tussah waste. Occasionally the difference between the prices of the two qualities was similar than this. We are quite unable to say what Eri cocoons are worth to-day, as it is a business which would have to be revived in England. We have not sold any Eri cocoons, either of Assam or other production, for ten years, and the mill which in former years used to employ the greater proportion of the English importation is no longer in existence.

The small sample you send is clean and of good colour, but the proportion of chrysalis is, we think, larger than in the case of the Assam cocoons which we used to handle, and the silk does not seem to us quite so rich. If your correspondents in Seychelles have any quantity available, and care to send over 2/300 lbs., for trial we will have some tests carried out".

"The difference in the prices quoted for the cocoons by the referees may be explained by the fact that the firms consulted represent different branches of the trade. Messrs H.T. Gaddum & Co., a firm of brokers, are in a position to quote prices only by comparison with a competing article, in this case Tussah waste, which is now selling at 5½d. per lb.; but manufacturers or merchants such as Messrs Lister and Co. and Messrs Thos. Taylor and Co. with experience of the properties and yield of the material, are able to make better offers".

Remarks.

"During recent years the Committee have from time to time considered the commercial prospects of Eri silk on the United Kingdom market and in 1930 a Sub-Committee was appointed to deal with the general question. The following statement summarises the present views of the Committee.

Eri silk, which is not reelable like mulberry silk, is classed as a waste silk and finds its application in the spun silk trade. In recent years the commercial position of waste silks in this country has been affected by the closing of markets which before the War were large purchasers of spun (waste) silk fabrics, and by changes in fashion, the competition of rayon (artificial silk) and other factors. Eri silk, for example, has been utilised hitherto in the manufacture of velvets, but rayon is now being employed to a very large extent for this purpose.

Nevertheless, Eri silk would probably find a market in this country for special purposes if it could be obtained at a sufficiently low price to compete with other waste silks and if supplies were available regularly and in commercial quantities. So far it has not seemed possible for producers even in India where large quantities of Eri silk are raised to meet all these conditions, the controlling factor being that of price. In India, for example, the price locally obtainable for the cocoons much exceeds their market value in England. For this reason proposals to export the cocoons to this country have been abandoned for the time being and other methods of developing the industry are being considered.

In these circumstances the Imperial Institute Silk Committee have not been able to recommend the production of Eri silk cocoons in countries seeking a new industry unless the silk is intended for use in a local weaving industry: the raising of cocoons for export is not likely to be profitable under the present conditions of price unless the cost of production is very low.

These facts will need to be taken into careful account by the Agricultural Department in the Seychelles in deciding as to the raising of Eri silk in the Colony. The cocoons submitted for examination proved to be of good quality but their production may not be a commercial proposition.

In this connection it may be mentioned that at present time the Committee is assisting the Department of Agriculture in the Gold Coast to obtain Eri silk "seed" for experimental purposes with a view to the establishment of a local silk weaving industry in that country."

14th February, 1934.

Details of Administration.

Expenditure and Receipts.

Expenditure.

1. Agriculture Personal Emoluments and other charges...	Rs 19,333.21
2. Forestry, Rivers and Crown Lands Reserves ...	... „ 4,941.04
3. Upkeep Botanical and Public Gardens ...	... „ 3,975.04
4. Destruction of Rats ...	... „ 2,382.24
5. Fisheries ...	... „ 580.40
	Rs :— 31,211.93

Receipts.

The Revenue consist of :—

Receipt from plantations ...	Rs 1,534.95
Sale of timber from Crown Lands ...	... „ 267.70
Rent of Crown Lands and Buildings ...	... „ 20,596.67
Royalty on Guano ...	... „ 13,081.00
„ „ timber from Aldabra Island ...	... „ 85.82
	Rs :— 35,566.14

Correspondence and distribution of information on Agricultural matters.

2,043 letters were despatched from the Department's Office. The number of Minute Paper dealt with was 532.

Various pamphlets and copies of reports were distributed to planters interested.

Visit to Estates and Agricultural Instruction.

Frequent visits were made by the Senior Officers of the Department to estates in the Mahé and Praslin Group. Special attention was given to advising planters concerning the planting and management of new crops. Visits by planters to the nurseries and experimental plots are now much more frequent.

Summary of legislation affecting crops and fisheries.

Ordinance No. 11 of 1903 provides for the control of Crown Lands, the establishment of River Reserves and the appointment of Forest Rangers.

Ordinance No. 7 of 1919 regulates by licence the local sale and removal of the principal agricultural products.

Ordinance No. 12 of 1925. Controls the importation of all plants and provides for the treatment and eradication of Plant Pests and Diseases.

Ordinance No. 3 of 1926. Authorises the issue of certain fishing licences to control the capture of, and trade in whalers and certain fish in colonial waters.

Ordinance No. 9 of 1928. In connection with the manufacture and sale of the liquor called Bacca. The Ordinance imposes a tax on lands planted in sugar cane.

Ordinance No. 7 of 1929. Regulates the Fisheries of Seychelles, establishes reserves, and prohibits in these reserves the use of nets and basket traps of certain specified dimensions, this Ordinance being amended by Ordinance No. 14 of 1932 which provides for the licensing of all fishing nets.

Ordinance No. 11 of 1932. Provides for the compulsory examination and certification of Patchouli oil, prior to export.

Ordinance No. 24 of 1932. Amends Ordinance No. 11 of 1903 and extends the limits of the river reserves situated more than 556 feet above sea level.

Ordinance No. 7 of 1933. Fixes a close season beginning on the 15th July and extending until the 1st September, during which the collection of eggs deposited by the Goelette or Sooty Tern (*Sterna fuliginosa*) is forbidden.

Reafforestation.

The following table gives the numbers of trees and shrubs planted, and quantities of seed at Niol, the Public Gardens and Coco-de-mer reserves at Praslin.

PLANTS.	Niol	C.L. Bot. Gardens.	Coco-de-mer reserves.	Total.
<i>Acacia regina</i> (Flamboyant) ...	55	—	—	55
<i>Albizia</i> ...	85	—	—	85
<i>Boerhaavia Seychellarum</i> (Coco-de-mer) ...	6	—	80	86
<i>Conocarpus grandis</i> (Teck) ...	127	—	—	127
<i>Dimorphanthera Litchi</i> (Litchi) ...	2	—	—	2
<i>Eucalyptus</i> <i>Roxburghii</i> ...	25	—	—	25
<i>Eucalyptus</i> sp. ...	500	250	—	750
<i>Guajacum</i> various species ...	1	80	74	156
<i>Mangifera indica</i> (Mango) ...	5	—	4	9
<i>Stemodia bijuga</i> (Gayac) ...	50	—	—	50
<i>Stemodia</i> sp. ...	5	—	—	5
<i>Spice</i> <i>officinalis</i> (all-spice) ...	—	—	5	5
<i>Areca</i> nuts ...	—	127	—	127
<i>Juniperus</i> <i>equisetifolia</i> (cedars) ...	90	720	—	810
<i>Myrsine</i> <i>parvifolia</i> (Mountain Takamaka) ...	30	—	—	30
<i>Santalum</i> <i>Koetjape</i> (Santol) ...	50	—	—	50
<i>Dracaena</i> <i>indica</i> (Sangdragon) ...	40	—	—	40
<i>Myrsine</i> <i>aromatica</i> (clove) ...	125	—	—	125
<i>Terminalia</i> <i>Catappa</i> (badamier) ...	327	—	—	327
	1523	1177	163	2863
SEEDS.				
<i>Areca</i> <i>catechu</i> (Areca nuts) ...	—	—	610	610
<i>Santalum</i> <i>Koetjape</i> (Santol) ...	—	—	12	12
<i>Swietenia</i> <i>mahogani</i> (Mahogany) ...	123	—	30	153
<i>Cassia</i> sp. (Palmyrah) ...	—	—	135	135
<i>Myrsine</i> <i>inophyllum</i> (Takamaka) ...	—	—	11	11
<i>Cinnamomum</i> <i>zeylanicum</i> (cinnamon) ...	—	—	1500	1500
<i>Phaseolus</i> beans ...	—	—	2(lbs)	2
<i>Stylobium</i> <i>verrucosum</i> (gum copal) ...	—	—	300	300
	1651	1177	2761	5589

Fisheries.

The following table shows the quantities of guano, fishery products and bird's egg yolk exported from the Colony during the past five years.

		1929	1930	1931	1932	1933
Guano	tons	12,789	15,977	4,730	14,213	12,307
FISHERY PRODUCTS.						
Calipee	Kos	4,226	4,120	4,186	5,743	4,788
Fish fresh	"	1,045	—	—	—	—
" salted	"	—	—	1,100	6,366	14,850
" oil	"	—	—	—	800	—
Shark fins	"	865	1,095	1,433	1,178	—
" meat	"	6,061	9,647	350	—	7,200
Tripangs	"	6,061	9,647	7,673	4,107	1,933
Turtle Oil	lbs	1,000	4,225	—	4,500	700
" strips	Kos	1,314	2,567	2,511	—	—
" shell	"	663	—	—	504	514
" meat (dried)	"	—	—	—	2,337	1,580
Shark skins	"	—	—	300	—	1,489
" oil	lbs	—	—	170	—	—
Tortoise shell (caret)	Kos	995½	1,323½	1,008	1,434	1,191
Birds' eggs (yolk and albumen)	"	29,170	70,300	95,750	55,240	57,400

There has been no large scale development of fisheries during the year. The export trade is conducted by a few individuals who deserve credit for the plucky way in which they are tackling their difficulties of finding markets for their fish and improving the quality of their products. There seems to be no doubt that if capital was available to exploit the Seychelles fisheries on a really extensive scale, with modern appliances, and on a carefully prepared plan, the resultant industry would go far to bring back prosperity to the islands.

A letter received from Mr James Hornell F. L. S., F. R. A. I., was communicated to persons interested. In this letter Mr Hornell stated the possibilities of sale in the United Kingdom for (1) dried batons of shark flesh, (2) Fish maws or sounds and (3) dried turtle flesh. He thought it a real and definite opportunity for setting the fishing industry on its feet provided quality and continuity of supply was maintained.

The fisheries guard in charge of the reserves at Mahé took 24 persons in contravention and seized 103 fishing baskets (Casiers) with under-sized meshes during the year.

*Manufacture.***BIRDS' EGGS.**

The following extracts from a memorandum on egg products received from the Imperial Institute are of interest.

"In the manufacture of egg products in the United States each egg is in the first instance cancelled to test its quality, bad ones, being discarded. They are then passed to a room kept at a constant temperature of about 60 F. to 65 F. where they are broken separately by hand, the contents of each egg being received into a cup for inspection before the albumen and yolk are added to the bulk. In China the albumen and yolk are commonly separately by hand, the girls who break the eggs allowing the white to run away from the yolk between their fingers.

"The dried products are made by evaporating the yolk or albumen by one of the various means that are commonly employed for evaporating liquids. In China the practice was formerly to evaporate in zinc trays, but this resulted in serious contamination of the product, and aluminium is now generally employed, the liquid being evaporated on aluminium bands several hundred feet long moving through a tunnel in which hot air is circulated. A more up to date method is to spray the liquid into a heated chamber, by which means it is obtained in the form of a dry powder. The spraying method has the advantage of being very rapid, and is now commonly employed for making dried food products, notably in the case of milk".

"The weight of eggs to produce 1 lb. of dried products is difficult to state exactly, but from such information as is available at the Imperial Institute it may be taken that the weight is from 3 to 4 lb"

Preservatives.

"In the manufacture of eggs products in China preservatives are sometimes used, particularly salt and boracic acid. There is no objection to these preservatives in egg products intended to be used for certain industrial purposes, but they must not be employed if the products are to be used in the preparation of foodstuffs. A partially evaporated product known as "glycerinated hen yolk" which is imported into the United Kingdom from China contains 10 per cent of glycerine, added as a preservative, and can be used in foodstuffs. This product is of a soft buttery consistency, and is understood to be preferred in this country to the dried yolk, for which there is a greater demand on the Continent of Europe.

21st June 1934.

F. L. SQUIBBS
Director of Agriculture

Meteorological Register.

Monthly Rainfall taken at the Port Office, Victoria, 1913—1933.

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	Monthly Mean Rainfall
January	6.29	14.99	8.32	9.31	12.93	24.18	18.02	32.63	15.80	5.33	19.31	12.60	25.25	10.77	7.84	16.72	13.19	6.18	11.16	15.13	16.96	14.19
February	7.31	9.85	26.22	7.17	10.12	4.64	11.94	5.95	13.36	1.78	14.29	1.85	13.65	15.85	.60	14.78	12.44	8.85	18.68	1.00	12.05	9.97
March	11.14	16.91	3.65	6.96	1.68	2.33	12.86	12.58	4.75	11.94	12.15	15.14	22.76	7.48	1.62	22.72	14.75	7.19	2.02	12.12	9.01	10.08
April	4.96	12.48	9.27	9.25	9.69	2.34	6.53	0.76	8.58	3.57	9.07	16.27	14.52	10.42	5.13	14.74	5.66	6.55	2.21	.93	7.00	7.61
May	2.71	9.46	6.01	8.06	0.45	2.92	13.42	6.66	7.66	5.73	8.17	4.93	5.70	16.26	6.71	15.64	3.78	3.51	9.80	5.53	6.01	7.15
June	3.34	2.45	2.32	4.29	1.09	0.95	9.25	3.50	1.20	4.10	4.47	3.42	1.16	15.94	7.24	2.69	.67	3.62	4.06	1.87	4.05	3.89
July	4.81	1.05	0.90	5.63	3.67	1.41	4.78	2.39	7.05	2.16	0.48	7.07	4.98	11.12	1.92	3.12	1.36	3.42	2.44	2.44	2.06	2.59
August	2.35	0.75	3.60	0.50	3.18	1.78	0.44	0.87	1.06	1.63	4.37	0.91	5.79	2.14	1.05	0.55	1.79	1.87	1.14	1.64	2.02	1.88
September	0.24	10.95	19.61	0.50	3.96	14.23	4.85	No Record.	0.32	4.69	6.93	8.13	5.35	.14	5.04	2.53	1.44	8.68	.14	4.14	5.07	5.19
October	2.50	10.88	9.14	1.13	0.45	9.14	5.05		2.34	9.91	15.35	12.24	10.79	4.49	14.09	1.83	3.24	2.11	8.41	12.65	5.00	6.70
November	8.34	8.05	10.88	4.40	6.94	8.92	1.23	7.84	7.84	1.88	8.85	10.75	15.58	7.52	5.36	10.23	5.17	20.59	5.78	5.97	9.05	7.82
December	13.72	11.25	14.96	10.18	12.06	9.95	12.66	15.20	16.11	3.50	8.10	15.05	8.77	20.89	10.59	28.80	10.94	13.25	29.30	10.18	13.05	13.73
Total	67.71	109.07	114.88	67.38	66.22	82.79	101.03	80.54	86.58	57.22	101.62	118.36	134.30	123.02	67.19	134.35	74.43	85.82	95.14	73.60	96.06	...

Average year = 92.25 inches.

Summary of the report by Mr. W. Holdsworth-Haines on an Investigation into the Essential Oil Industry of Seychelles.

Introduction.

As far as possible, the work has been conducted, not only with a view to obtaining strictly scientific data but with the object of securing information of practical value at the same time, thereby economising time and material.

During my stay, a number of experimental distillations were carried out at three large private distilleries, and with few exceptions, I visited every distillery in the Colony. During most of these excursions the Assistant Director of Agriculture gave me much valuable assistance. Many of the distillers came to see me at my distillery, some visiting me several times. Such visits were welcome, and most useful from the instructional point of view. On occasions I have always given local distillers facts and figures useful to the practical man, and results of experimental value only, I have considered it prudent to withhold.

Several meetings of the Planters Association were attended by me.

Local Distilleries.

Of the eighty seven distilleries in the islands, there are four devoted solely to the distillation of patchouli, sixty-seven to cinnamon leaf, and sixteen where both patchouli and cinnamon leaf are distilled. Twelve of the distilleries possess steam boilers, one works at atmospheric pressure and the remainder are of the under-fired type and are of local or European construction. Under normal conditions, the efficiency of the stills is in the order above named, but some of the under-fired stills are being used more effectively than the pressure type, which is normally the more efficient. The majority of the stills are under-sized for the speed at which they are run, and whilst it is not suggested that this speed should be lessened, there are certain features of the stills which could with advantage be altered.

Still Bodies. In general the ratio of height to diameter is roughly one to one, a proportion which does not permit of adequate contact between the leafy material and the steam. Efficiency would be improved if the ratio of height to diameter were one to two or two and a half. This could be effected in many cases by the introductions of "belts" in order that the heights of the still-bodies be increased. The capacities of the still would thereby be increased and a larger time for distillation with a given quantity of water will be necessary. Efficiency would, however, be increased. For some years local efforts have been made to improve the efficiency of distillations by the introduction of inverted "V" grids but the results of these efforts have not been satisfactory as these grids lower efficiency by shortening the time of contact between the steam and the leaves.

Condensers. All the condensers, even those of European make are undersized. Allowance has not been made for the difference in average temperatures of the cooling water in Europe and the Seychelles. With cooling water at an average of 30° C., cooling surfaces should be at least 33½ per cent in excess of that usually provided in Europe, and there would be no objection to their being increased to even 50% over the European standards. Vats holding condenser coils should also be provided for the large entrances and exits for the cooling water. If this is done, the temperature of the water in the vats could be maintained within a degree or so of the temperature of the water of supply, and such an arrangement should be easily possible in the Seychelles as there is an adequate water supply available.

Separators. The common types of separators used consist generally of small metal cylinders averaging from about 15 centimetres to 25 centimetres in diameter, and from half to one metre in length. They are, for the most part, locally constructed and are so made that easy and thorough cleaning is difficult. This is a definite drawback, as cleanliness is essential in the working of an Essential oil distillery. The diameters of the separators should be increased up to 50 centimetres in order that the rate of flow of the distillate through them may be reduced. The temperature of the distillate flowing from the condenser is naturally higher than would be experienced in Europe, and it will be appreciated that with a liquor containing oil the rate of flow through the separator should be lessened when temperatures are increased.

Heating. The abandonment of the under-fired type of still in favour of boiler units is recommended. In the latter, fuel is consumed to much greater advantage than in the case of open grates. The majority of the existing under-sized stills are provided with large grates with the fire immediately under the still. The chimney is usually directly behind the still and the greater part of the heat is in consequence carried to the back of or beyond the still. There is in consequence a great loss of efficiency in fuel consumption which accounts for the high costs and large consumption by this type of still. It was observed that the greatest heat from the fire appeared to be in the chimney throat or actually in the chimney itself. In a few cases, chimneys have been provided with dampers, but the use of these dampers for preventing excessive loss of heat appeared to be unknown.

Fuel.

Wood is being used less as a distillery fuel and is being replaced by vegetable waste materials such as coconut husks and batons. This is due to shortage of wood by the depletion of the hillside forest cover and the position will become increasingly difficult unless re-forestation is undertaken. The general opinion is that the use of coconut husks and batons as fuel

results in a smaller outturn of oil than when wood is used. These lower yields are in fact chiefly caused by inattention on the part of the stokers, as with quick burning material the fire has to be fed much more frequently than when wood is used. With wood, it is possible to provide for a steady run for a considerable period, but in order to accomplish the same with quick-burning materials much more frequent stoking is required if regularity is to be maintained.

The fuel supply is of as great importance to the industry as the supply of oil-bearing raw materials. It accounts for approximately 50o/o of the cost in even the most efficient distilleries. Wood in favoured locations costs Rs 1.50 to Rs 2.00 per cord—the price of the cutting, but when bought in the market it costs between Rs 6 and Rs 10 per cord.

The following table shows the comparative costs of fuel in 42 distilleries from which data were procured.

Comparative cost of fuel per litre of cinnamon leaf oil produced.

Number of Distilleries.	Fuel costs per ton. of leaves.	Cost of fuel per litre of oil.
3	Rs 2	Rs 0.30
2	Rs 4	Rs 0.60
9	Rs 6	Rs 0.80
7	Rs 8	Rs 1.10
12	Rs 10	Rs 1.40
6	Rs 12	Rs 1.70
3	Rs 15 to Rs 20	Rs 2.00 to Rs 3.00

Distilleries which are still burning wood as fuel usually use it green. In many cases, wood which had been cut the previous day is used. This seemed to be a wasteful process and experimental work was, therefore done in order to ascertain if improvements could be effected.

The following table gives the weight of fresh wood per cord, together with the relative amounts of water per cord, they will evaporate at a working pressure of 40lbs.

It should be emphasised that these figures are purely relative and applicable only to the boiler in which the experiments were conducted. They can in no way be compared with the consumption of wood in any other boiler, except in a relative fashion.

		Age of moisture of air drying.	Ft. per cord.	litres of water per cord of fresh wood.	litres of water per cord with air dried wood.	litres of water per cord of fresh wood in logged boil.
Albizzia	...	52o/o	623 ks.	399	470	483
Cashew	...	46o/o	700 ks.	462	534	571
Rubber	...	38o/o	934 ks.	523	653	687
Acacia	...	28o/o	584 ks.	700	803	893
Cedar (Casuarina						
Equisetifolia)	...	28o/o	664 ks.	946	1,014	1,024
Pruen	...	27o/o	552 ks.	463	—	523
Cinnamon ex-bark						
preparation	...	26o/o	525 ks.	500	560	615
Gum Copal	...	26o/o	838 ks.	670	880	905
Agati	...	25o/o	504 ks.	660	790	815
Capucin (Northea						
Seychellana)	...	...	794 ks	1,280	—	1,491
Coconut husks	...	...	1,000 husks.			per 1,000
			433 ks.	303	—	483
Coconut shell	...	...	1,000 ks.	1,010	1,000 ks.	1,760

From the foregoing table, the advantages of using air dried fuel will be readily recognised, a saving of one cord in 4 or 5 being effected by this alone. Although the table only shows the additional evaporation of water from fresh wood with logging, it can easily be appreciated that a double advantage is to be gained by using air dried fuel in an efficiently lagged boiler.

The cost of lagging material is approximately £27. per ton plus freight to which must be added the cost of application which would be small. The covering power of a ton of lagging material is approximately 2400 sq. ft. Local labourers experienced no difficulty in applying the lagging to the boiler used in this investigation, and it must be remarked that the result was a good work-manlike job.

Considering the already depleted supplies of wood, it is urged that all wood used as fuel should be dried before use, and that all steam heated surfaces should be "lagged."

Cinnamon.

This tree grows wild, and is mainly confined to the higher altitudes. Tracts of country formerly well covered with cinnamon are now largely depleted, and it is generally recognised that this has been brought about by over-cropping. If the industry is to continue some degree of conservation will become necessary in the not far distant future. At intervals, cinnamon received a so-called pruning, which consists of cutting the bushes down to within 12 inches of the ground. Much better results would be secured if this pruning were done at ground level, and the cut surfaces covered with earth. This system of cropping has been repeatedly suggested by the Imperial Institute, and one planter who has adopted this stem found that a large increase of straight shoots were secured.

Some cinnamon is also grown as an inter-crop in the coconut plantations, but from such areas the oil yields are low.

Harvesting leaves.—The collection of leaves is carried out by men and women under a "contract" system whereby they are paid per ton of leaves collected and transported to the stillery. The daily quota is approximately 40 kilos for a woman and 50 kilos for a man and the average price paid by a proprietor to collectors of leaves from lands owned by himself is approximately Rs 4.00 per ton. In addition foremen are employed. These supervise the collectors and are paid a monthly wages of approximately Rs 17 which equals about Rs 1.00 per ton of leaves. The transport of raw material is invariably included with collection in the "contract" prices agreed upon.

A considerable number of experimental distillations were carried out and the following conclusions can be drawn from the data which were secured :—

(1) The maturity of cinnamon leaves is not attained in twelve months growth and the necessary time appears to be between 18 months to two years with trees growing under good conditions.

(2) Seasonal variation of the oil content in the leaves does not appear to occur during the first year's growth, but during the second year's growth a maximum is reached in the two months prior to the "repousse" or growth which takes place in May and September.

(3) Of the two types of distillation, steam and water, the steam method is superior.

(4) Material used for distillation should be as fresh as possible.

(5) The rate of distillation is largely immaterial if efficient condensation is provided.

Cinnamon Leaf Oil.—The exports of cinnamon leaf oil during 1932 amounted to 9,679.75 kilos as against 54,793 kilos in 1931. Local prices in 1932 averaged from Rs 4.50 per litre in January to Rs 3.00 in April and touched Rs 4.00 in the last few months of the year. London prices ranged from the equivalent of Rs 3.29 to Rs 4.27 per kilo. The following table gives the costs of production of 47 distilleries in January, 1933.

Number of Distilleries.	Percentage of total production in the Colony.	Average production cost per litre.
2	4.0 o/o	Rs 1.25 or less
2	0.8 o/o	Rs 1.75 or less
12	24.0 o/o	Rs 2.25 or less
10	18.0 o/o	Rs 2.75 or less
12	29.0 o/o	Rs 3.25 or less
5	8.7 o/o	Rs 3.25
4	2.5 o/o	Rs 3.25 or more

Twenty distilleries were not working, nine had been abandoned and from seven no information was received.

The producer in the Seychelles receives the equivalent of the full London price without deductions for packing, freight and insurance. This appears to be due to the lack of banking facilities in the Seychelles and the local merchants' need for credit in Europe or America. The oil is purchased by these merchants as a method of drafting credit. Co-operative marketing has been discussed but it is doubtful if this method would be of advantage to the producers as they receive at the present time values which represent the full London values plus an addition which is equivalent to the charge which would normally be made for banking facilities. At least a quarter of the distilleries in the islands appear from their own information to be making a profit of from 25 to 50 cents per litre with cinnamon leaf oil selling in the Seychelles at Rs 3.25 to Rs 3.50 per litre.

Cinnamon Bark Oil.—Large quantities of cinnamon bark oil were produced in the Seychelles in 1916 but at the present time no such oil is distilled. The oils formerly produced were of low quality and the aldehyde content appears never to have exceeded about 36 o/o.

In 1930, a fairly large distillation of cinnamon bark was carried out by the writer on the Cascade Estate, Mahé. This bark yielded 8 litres of oil per ton and the oil had a good pour and had on absorption in sodium bisulphite of over 67 o/o and a specific gravity heavier than that of water.

Experimental work was continued during the present investigation and it is estimated that if all the bark of the cinnamon now used as fuel were employed for the distillation of bark oil a production of 3,860 litres should have been possible in 1932 of an export value of Rs 96,500. The presence of cinnamic aldehyde is greater in the younger than it is in the older growths. Thick corky bark appears to give a light oil and therefore is not suitable. Stems 10 feet high with a diameter of $1\frac{1}{2}$ —2 inches at the base and covered with the epidermis brown in colour give the best results. The bark from such stems should be stripped as quickly as possible after collection and the bark may be dried if necessary provided that during drying contamination with other materials is prevented and mould growth not permitted to take place.

All apparatus to be used for distillation must be scrupulously clean and the still should be filled as full as possible, the bark being well packed down. Distillation should commence with saturated steam (super-heated steam must not be used) and continued until the distillate is free from oil. The first signs of this is the change in colour of the distillate from milky (*i.e.* liquor containing oil) to colourless and the final point determined by taste. For a normal bark the amount of liquor from this first operation will be approximately $1\frac{1}{4}$ to $1\frac{3}{4}$ times the weight of the bark in process and a vessel or vessels large enough to hold this liquor should be provided. An oil lighter than water separates from the "milky" liquor. This is removed and if the apparatus is clean it will be light yellow in colour. The quantity of light oil from a normal bark should be approximately $2\frac{1}{2}$ to 3 litres per ton.

When this first operation is complete, the spent bark should be removed from the still which is made ready for the re-distillation of the "milky" liquor. This is placed in the now empty still and heating commenced with the closed coil (*serpentin de chauffe*). The distillate will be "milky" as before and from this an oil heavier than water will separate if the cooling and concentration is sufficient. The amount of liquor will be approximately half the amount returned to the still and the total amount of heavy oil obtained should be equal in volume to that of the light oil already separated. If the full quantity of heavy oil is not obtained in the first re-distillation, the liquor should be again redistilled. Both heavy and light oils from this same bark are mixed and the final bulked oil should be heavier than water.

Care must be taken that bark alone is distilled when the bark oil is being produced. Leaves must not be included. It is also essential that stills previously used for distilling leaf oil and all vessels similarly used should be thoroughly cleaned before they are employed for bark distillations. Otherwise, the quality of the resultant oil is inferior.

Patchouli.

This plant is established between the palms in coconut plantations and by the copious use of spent cinnamon leaf and other manures three crops a year are usually obtained. Experimental investigations indicate that drying the leaves increases the oil content but does so at the expense of quality. Fermentation of the leaves appears to obviate this to some degree. The experiments showed the decreasing volume of oil per volume of steam used and that the soluble portions of the oil are those which distil towards the end of the distillation emphasising the importance, if quality is to be considered, of completely exhausting the leaf under process. Furthermore the importance of bulking all the oil from a given distillation must not be overlooked.

Trouble has been experienced from time to time by local distillers by the production of a patchouli oil green in colour. This is due to contamination with copper of an oil with a high acid value and excessive fermentation of the leaves will produce an oil of a high acid value. The green colour, but not the high acid value, may be removed by the addition of a small quantity of powdered tartaric acid. If the oil is of an excessive brown colour it is likely that iron has been the cause and the brown colour may be removed in a manner similar to that described above in cases of contamination with copper. The colour of Patchouli oil distilled under good conditions is a golden yellow to light brown, and a good coloured oil cannot be produced unless cleanliness is practised. The costs of the production are shown in the following table :—

Number of distilleries.	Percentage of Colony's production.	Cost per litre
3	27.5 o/o	@ Rs 1.24 per litre
1	3.4 o/o	@ „ 1.60 per litre
1	3.4 o/o	@ „ 2.00 per litre
3	10.0 o/o	between Rs 2.50—2.90 per litre
1	20.0 o/o	„ Rs 6.00—7.00 per litre
2	12.0 o/o	
1	6.8 o/o	@ Rs 7.00 per litre
3	13.0 o/o	@ Rs 7.50 per litre
1	Not working	No records or accounts kept.
4	Information not forthcoming	

Forty-four per cent of the Colony's production of patchouli oil is produced at less than Rs 3.00 per litre. Prices in 1932 ranged from Rs 9.00 to 10.00 per litre and the production in that year was 2,424 kilos.

The Seychelles oil under careful distillation does not differ materially from the Singapore oil, but the Department of Agriculture has recently received plants reputed to be the Penang variety of patchouli and the leaves of these plants seemed to be quite distinct from the Seychelles variety. No experimental distillations were possible owing to lack of sufficient material, but it is obvious that such test distillations are necessary in order that the quality of the oil may be tested before the replacement of the local type is recommended. In the event of this introduction showing that a plant suited to local conditions capable of producing a high quality oil has been obtained, measure should be taken systematically to replace the existing type. In the meantime the correct methods of patchouli growing should be encouraged amongst the small holding class of peasantry, as the plant grows well under the conditions existing in the Seychelles.

Ordinance 11 of 1932 provides for the grading of Patchouli oil and enables the Department of Agriculture to test all consignments exported from the Colony.

This will, in course of time, have the effect of restoring the prestige of the Seychelles product. At present consignments are contained in exporters containers and samples are drawn from each for testing. A system of locked vats of from 50—60 gallons capacity in the Customs warehouse to be hired to exporters might assist the industry, as it would provide a satisfactory system of bulking and permit of one sample being drawn per consignment.

Palmarosa and Ginger-grass.

The amount of *Cymbopogon martini* var *motia* growing in the Seychelles is small and some confusion exists in the island in regard to its identity. Only a few kilos of the true palmarosa grass could be secured for experimental distillation and the odour of the oil from the flowering heads was particularly good. The prospects for any distiller who will secure the true palmarosa and take trouble with its distillation appear to be good.

Cymbopogon martini var. *sofia* the source of ginger-grass oil, is growing in fairly large quantities in different parts of the island of Mahé, and it is possible that its cultivation has been undertaken in error for palmarosa. Experimental distillations were made with this grass and the odour of all the oil secured was definitely that of ginger-grass.

Lemon Grass.

The varieties of this grass are distinguished in the Botanic Gardens as "Red" and "Pink" Experimental distillations were made with three-month old grass from each kind, as well as of older grass from clumps stated to be *Cymbopogon flexicosus* and *Cymbopogon citratus*.

Grass three months old does not yield as highly as the older grass but in order to secure an oil of high citral content young growth should be used. Yields of 3 to 3½ litres per ton, with a citral content of 85—90 o/o have been secured from grass five—six months old.

Vetivert.

A number of experimental distillations were made with vetivert roots. An average yields of three litres per ton of dried roots was obtained. The odour of the oil obtained was extremely fine.

Eucalyptus citriodora.

Experimental distillations were made. Leaves six—twelve months of age gave yields equal to 16.21 litres of oil per ton and leaves from young growth four months later from the same trees gave yields equal to 16.6 litres of oil per ton.

With re-cropping at four monthly intervals it seems that yields of about 15 litres per ton of leaves might reasonably be expected. Distillation is rapid and simple and presents no difficulties.

This tree could be used for re-forestation as it has a considerable value as fuel even if there might be some difficulty in securing a market for the oil. The new Economic Nursery is preparing to meet demands from planters for seedlings of this plant—seed having been imported from South Africa for propagation.

Other Eucalyptii.

Distillations were made of fresh leaves *Eucalyptus filicifolia*. A yield of 10 litres of oil per ton was secured. *Eucalyptus tereticornis* gave a yield of 4.2 litres of oil per ton of leaves and *Eucalyptus alba* a yield of 2.8 litres per ton. Oil from the last species was devoid of cineol-like odour and in the case of the first—two the cineol content was low.

Miscellaneous Oils.

Distillations were also made of Pimento leaf oil and a yield of 6.8 litres per ton was obtained.

Nutmegs yielded a return of 64.3 litres of oil per ton.

Cardamoms gave a yield of 51 litres of oil per ton.

Ocimum viride yielded 3.9 litres per ton and *Ocimum canum* gave a yield of 1.3 litres per ton.

Prospect of Co-operative Production of Essential Oils in the Seychelles.

It was expressly desired that the possibilities of establishing a co-operative system of production should be investigated. Some form of co-operation is obviously desirable if the industry is to make progress, but there are many difficulties by reason of the physical nature of the islands to be overcome. In 1931, His Excellency the Governor set up a Committee to study the subject of co-operative marketing but the scheme proposed would not, in my opinion, have been of benefit to the industry. It would have been preferable to have advanced by degrees. Several groups of neighbouring planters should be formed, and each group should possess a steam driven plant. At present there are twelve steam distilling units in the Seychelles, but one of these is too small for use as the centre of group distillation. The present Planters Association should be able to encourage the formation of these co-operative groups which would be spread fairly evenly throughout the island of Mahé if located around the existing steam distilleries. Local conditions are not suitable for the establishment of a small number of central distilleries. In such distilleries skilled supervision should be required and the continued scientific checking of the raw material supplied would be required. Such provision would be impossible to secure. The group system, however, is simply an amalgamation between local enterprises, and the present owners should be able to provide all the supervision that would be required.

Summary of Recommendations.

Local Stills.—1. The proportions of the still bodies should be altered so that the ratio of height to diameter is 2 to $2\frac{1}{2}$ to one. Additional "belts" can be introduced in existing stills in order to increase height in relationship to diameter.

Condensers.—2. The actual cooling surfaces should be enlarged and larger cooling-water entrances and exits to the vats holding condenser coils should be provided.

Separators.—3. The diameter of the separators should be increased to not less than 50 centimetres.

Heating.—4. The under fired type of still should be abandoned in favour of boiler units.

Fuel.—5. The use of fresh green wood should be abandoned. Better results are secured from dried wood.

Cinnamon leaves.—6. Older leaves should be used for distillation and having regard to the disappearance of cinnamon trees from many parts of the Colony, the introduction of a close season is suggested.

Cinnamon Leaf Oil.—7. Distilleries provided with steam generators could improve their production by installing collecting vats of a capacity sufficient to hold a day's production. The mother liquor should be run into such vats and allowed to stand for 24 hours without disturbances. The vats should each be supplied with two cocks, one situated at the bottom and the other one foot from the bottom. Through the upper tap of the large bulk of the liquor when freed from oil can be speedily run away, whilst from the bottom the much smaller bulk of liquor consisting mostly of oil can be removed. An increase of an additional litre of oil per ton of leaves can be secured by the adoption of the above method.

Cinnamon Bark Oil.—8. Bark from stems which are approximately two inches in diameter give the best yields and care must be taken to prevent mould. The oils should be dried by treatment with powdered anhydrous sodium sulphite before packing and in order to maintain a good colour aluminium or glass containers should be used.

Patchouli.—9. Economy can be effected by collecting whole plants, which can be tied in bundles and hung up for drying prior to distillation. Fermentation does not appear to be necessary. Distillation should be done with dry saturated steam. After distillation the oil should be bulked and prior to filtration it should be treated with powdered anhydrous sodium sulphate to remove the water dissolved in it. The oil should be packed in aluminium, well-tinned iron, or glass containers.

Palmarosa.—10. The cultivation of this grass should be of great value, as it could be used on steep hillsides to check soil erosion. The cultivation of the only true palmarosa should be undertaken and ginger-grass should be eliminated.

Cardamoms.—11. Experimental propagation of cardamoms is worthy of consideration.

Co-operative organisation.—12. A group system of distilleries is recommended, and the existing twelve steam units could be used as centres for this suggested group organisation.

